



**(43) International Publication Date**  
**12 February 2004 (12.02.2004)**

**PCT**

**(10) International Publication Number**  
**WO 2004/013950 A3**

**(51) International Patent Classification<sup>7</sup>: H02M 3/158**

**(21) International Application Number:**  
PCT/IB2003/003226

**(22) International Filing Date:** 16 July 2003 (16.07.2003)

(25) Filing Language: English

(26) Publication Language: English

**(30) Priority Data:**  
102 34 080.3                      26 July 2002 (26.07.2002)      DE

**(71) Applicant (for DE only): PHILIPS INTELLECTUAL PROPERTY & STANDARDS GMBH [DE/DE]; Stein-damm 94, 20099 Hamburg (DE).**

(71) Applicant (for all designated States except DE, US):  
**KONINKLIJKE PHILIPS ELECTRONICS N.V.**  
 [NL/NL]; Groenewoudseweg 1, NL-5621 BA Eindhoven  
 (NL).

**(72) Inventors; and**

(75) **Inventors/Applicants (for US only): DÜRBAUM, Thomas [DE/DE]; Philips Intellectual Property & Standards GmbH, Weissshausstr. 2, 52066 Aachen (DE). ELFERICH, Reinhold [DE/DE]; Philips Intellectual Property & Standards GmbH, Weissshausstr. 2, 52066**

Aachen (DE). **TOLLE, Tobias** [DE/DE]; Philips Intellectual Property & Standards GmbH, Weissshausstr. 2, 52066 Aachen (DE).

**(74) Agent: MEYER, Michael; Philips Intellectual Property & Standards GmbH, Weisshausstr. 2, 52066 Aachen (DE).**

**(81) Designated States (national):** AE, AG, AL, AM, AT, AU, AZ, BA, BB, BG, BR, BY, BZ, CA, CH, CN, CO, CR, CU, CZ, DE, DK, DM, DZ, EC, EE, ES, FI, GB, GD, GE, GH, GM, HR, HU, ID, IL, IN, IS, JP, KE, KG, KP, KR, KZ, LC, LK, LR, LS, LT, LU, LV, MA, MD, MG, MK, MN, MW, MX, MZ, NI, NO, NZ, OM, PG, PH, PL, PT, RO, RU, SC, SD, SE, SG, SK, SL, SY, TJ, TM, TN, TR, TT, TZ, UA, UG, US, UZ, VC, VN, YU, ZA, ZM, ZW.

**(84) Designated States (regional):** ARIPO patent (GH, GM, KE, LS, MW, MZ, SD, SL, SZ, TZ, UG, ZM, ZW), Eurasian patent (AM, AZ, BY, KG, KZ, MD, RU, TJ, TM), European patent (AT, BE, BG, CH, CY, CZ, DE, DK, EE, ES, FI, FR, GB, GR, HU, IE, IT, LU, MC, NL, PT, RO, SE, SI, SK, TR), OAPI patent (BF, BJ, CF, CG, CI, CM, GA, GN, GQ, GW, ML, MR, NE, SN, TD, TG).

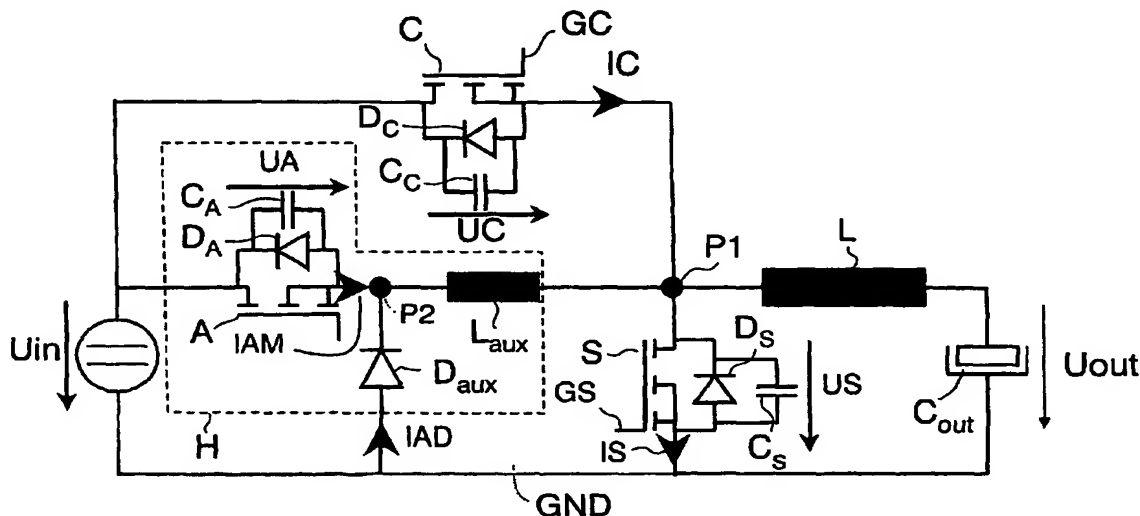
**Published:**

— with international search report

(88) **Date of publication of the international search report:**  
3 June 2004

*[Continued on next page]*

**(54) Title:** DC/DC DOWN CONVERTER



**(57) Abstract:** The invention relates to a DC/DC down converter which includes a synchronous rectifier (S), a switching element (C) at its input side and an inductance (L) at its output side. In order to permit fast load fluctuations as well as to reduce costs and operating losses, it is proposed to provide an auxiliary circuit which comprises an auxiliary switching element (A), an auxiliary rectifier (Daux) and an auxiliary inductance (Laux), the auxiliary circuit being coupled to the connection between the synchronous rectifier, the switching element at the input side and the inductance at the output side.



---

*For two-letter codes and other abbreviations, refer to the "Guidance Notes on Codes and Abbreviations" appearing at the beginning of each regular issue of the PCT Gazette.*

# INTERNATIONAL SEARCH REPORT

International Application No.  
PCT/IB-03/03226

A. CLASSIFICATION OF SUBJECT MATTER  
IPC 7 H02M3/158

According to International Patent Classification (IPC) or to both national classification and IPC

## B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)  
IPC 7 H02M

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practical, search terms used)

EPO-Internal

## C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category *	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	WO 99 56384 A (ZHAO LINCHONG) 4 November 1999 (1999-11-04) figure 7	1-6
L	-& US 6 525 513 B1 (ZHAO LINCHONG) 25 February 2003 (2003-02-25) column 9 figure 7	
Y	EP 0 896 418 A (LUCENT TECHNOLOGIES INC) 10 February 1999 (1999-02-10) paragraph '0020! - paragraph '0022! paragraph '0028!; figure 6	1
Y	US 2002/000795 A1 (WITTENBREDE ERNEST HENRY) 3 January 2002 (2002-01-03) paragraph '0067! figure 5	1

☐ Further documents are listed in the continuation of box C.

☒ Patent family members are listed in annex.

### \* Special categories of cited documents :

- \*A\* document defining the general state of the art which is not considered to be of particular relevance
- \*E\* earlier document but published on or after the international filing date
- \*L\* document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)
- \*O\* document referring to an oral disclosure, use, exhibition or other means
- \*P\* document published prior to the international filing date but later than the priority date claimed

- \*T\* later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention
- \*X\* document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone
- \*Y\* document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art.
- \*&\* document member of the same patent family

Date of the actual completion of the international search

20 January 2004

Date of mailing of the international search report

27/01/2004

Name and mailing address of the ISA

European Patent Office, P.B. 5818 Patentlaan 2  
NL - 2280 HV Rijswijk  
Tel. (+31-70) 340-2040, Tx. 31 651 epo nl,  
Fax: (+31-70) 340-3016

Authorized officer

Marannino, E.

## INTERNATIONAL SEARCH REPORT

International Application No

PCT/IB 03/03226

Patent document cited in search report		Publication date		Patent family member(s)	Publication date
WO 9956384	A	04-11-1999	CN	1209682 A	03-03-1999
			AU	2407599 A	16-11-1999
			BR	9906397 A	26-09-2000
			WO	9956384 A1	04-11-1999
			RU	2195067 C2	20-12-2002
			US	6525513 B1	25-02-2003
EP 0896418	A	10-02-1999	US	5914587 A	22-06-1999
			EP	0896418 A2	10-02-1999
US 2002000795	A1	03-01-2002	US	6198260 B1	06-03-2001